R E P O R T R E S U M E S

ED 011 054 95

A COMPARATIVE STUDY OF THE EDUCATIONAL ENVIRONMENT AND THE EDUCATIONAL OUTCOMES IN AN UNDERGROUND SCHOOL, A WINDOWLESS SCHOOL AND CONVENTIONAL SCHOOLS.

BY- COOPER, JAMES G. IVEY, CARL H.
NEW MEXICO STATE DEPT. OF EDUCATION, SANTA FE

PUB DATE AUG 64

CONTRACT OEC-3-99-033
EDRS PRICE MF-$0.18 HC-$3.64 91P.

DESCRIPTORS- *SCHOOL BUILDINGS, *SCHOOL DESIGN, *EDUCATIONAL ENVIRONMENT, *ANXIETY, *COSTS, ABO PROJECT

AN INVESTIGATION WAS MADE INTO THE EFFECTS OF AN ELEMENTARY SCHOOL-FALLOUT SHELTER UPON THE EDUCATIONAL CLIMATE WITHIN THAT SCHOOL AS COMPARED TO THE CLIMATES OF WINDOWLESS OR CONVENTIONAL SCHOOLS. THE ABO SCHOOL IN ARTESIA, NEW MEXICO, WAS BUILT WITHOUT WINDOWS AND ENTIRELY BELOW GROUND EXCEPT FOR THE ENTRY. INITIAL CONSTRUCTION COSTS WERE ABOUT 21 PERCENT HIGHER THAN FOR A CONVENTIONAL STRUCTURE. CUSTODIAL SERVICES WERE SOMEWHAT LOWER THAN FOR OTHER SCHOOLS IN ARTESIA. TEACHER VARIBLES WERE EXAMINED AND ANALYZED. IT WAS FOUND THAT THE ABO TEACHERS WERE VERY MUCH LIKE THE OTHER TEACHERS IN ARTESIA. THE STUDY OF PUPIL VARIABLES INCLUDED ANXIETY AND ATTENDANCE. NO EVIDENCE WAS FOUND TO INDICATE THAT THE ABO PUPILS WERE MORE ANXIOUS OR HAD ANY MORE ATTENDANCE PROBLEMS THAN PUPILS ATTENDING CONVENTIONAL OR WINDOWLESS SCHOOLS IN ARTESIA. NO EVIDENCE WAS FOUND DURING A 2-YEAR PERIOD TO RAISE ANY QUESTIONS ABOUT THE FEASIBILITY OF COMBINING A FALLOUT SHELTER WITH THE EDUCATIONAL FUNCTION. (TC)

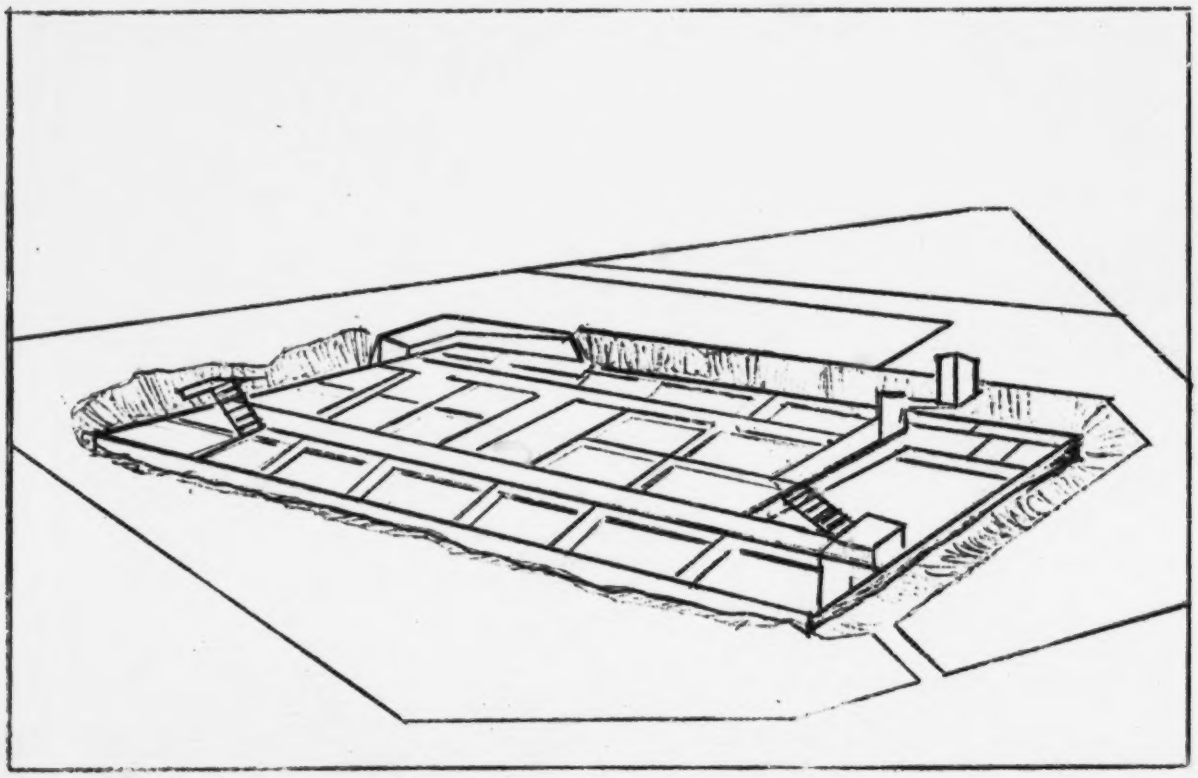
ED011054

O.E.-3-99-033

NEW MEXICO DEPARTMENT OF EDUCATION
Santa Fe
Leonard J. DeLayo, Superintendent

FINAL REPORT OF THE ABO PROJECT

U. S. DEPARTMENT OF HEALTH, EDUCATION AND WELFARE
Office of Education
This document has been reproduced exactly as received from the person or organization originating it. Points of view or opinions stated do not necessarily represent official Office of Education position or policy.



A Comparative Study of the Educational Environment and the Educational Outcomes in An Underground School, a Windowless School and Conventional Schools.

By

James G. Cooper, Research Coordinator
and
Carl H. Ivey, Research Assistant

August, 1964

The research reported here is supported through the Office of Education, U. S. Department of Health, Education and Welfare using funds made available for this purpose by the Office of Civilian Defense, Department of Defense.

Contract #OE-3-99-033

PRECEDING PAGE BLANK-NOT FILMED

ABO PROJECT STAFF

Project Director:

Leonard J. DeLayo, State Superintendent of Instruction
(June, 1963-Present)
Tom Wiley, State Superintendent of Instruction
(January, 1963-June, 1963)

Steering Committee:

Patrick D. Lynch, University of New Mexico (January, 1963-Present)
Virginia R. Keehan, New Mexico Department of Education and
U. S. Office of Education (January, 1963-November, 1963)
LaMoine Langstone, New Mexico Department of Education
(January, 1963-Present)
Vernon R. Mills, Superintendent of Schools, Artesia, New Mexico
(January, 1963-Present)
George P. White, New Mexico Department of Education
(January, 1963-November, 1963)

Consultants:

Arthur P. Coladarci, Stanford University, Chief Consultant
Virginia R. Keehan, New Mexico Department of Education and
U. S. Office of Education
Patrick D. Lynch, University of New Mexico
Don B. Croft, University of Utah
George Collins, U. S. Office of Education
William O. Wilson, University of New Mexico
Owen C. Taylor, Medical Consultant

Research Staff

Frank W. Lutz, Research Coordinator (February, 1963-February, 1964)
Susan B. Lutz, Research Associate (February, 1963-February, 1964)
James G. Cooper, Research Coordinator (February, 1964-August, 1964)
Carl H. Ivey, Research Assistant (February, 1964-August, 1964)

Project Secretaries:

Ruth Waldrep
Paola Quargnali

PREFACE

The results reported in this document are based upon research which was conducted from January, 1963, to the conclusion of the project in August, 1964.

A considerable amount of information concerning the project was summarized in an interim report of January, 1964 (Lutz & Lutz, 1964). Tentative conclusions in that document are restated and supported on the basis of the additional data collection and analysis which has occurred since the publication.

ACKNOWLEDGMENTS

The researchers experienced an unusual amount of cooperation from the many individuals who have been associated with the project since its inception. They wish to express their gratitude to Drs. George Collins and Virginia Keehan, now with the U. S. Office of Education, who first conceived of the research and submitted the proposal, and to Ralph Garrett, Systems Evaluation Division, Office of Civil Defense, whose cooperation throughout the project was excellent.

They are also grateful to Mr. Leonard J. DeLayo, the present Superintendent of Instruction of New Mexico and Abo Project Director. Thanks are also due to Mr. Henry Nelson and Mr. Albert Seeliger, Superintendent of Schools in the Nevada communities which participated in the research, and especially to Mr. Vernon R. Mills, Superintendent of Schools, Artesia, New Mexico.

To all who have served on the Steering Committee and as consultants, a sincere thank you is in order.

The authors also wish to express their appreciation to Dr. Paul V. Petty, Chairman of the Department of Educational and Administrative Services, University of New Mexico, through whose cooperation time for work on the project was made available.

Sincere appreciation as well as professional admiration are expressed for the outstanding research efforts accomplished by Dr. and Mrs. Lutz during their supervision of the Abo Studies. Much of the data treated in this document was collected under their direction

and inspiration. The responsibility for the interpretation of these data must, of course, remain with the present authors.

Last, but not least, they wish to express their thanks to Mrs. Ruth Waldrep and Miss Paola Quargnali, who served faithfully as secretaries.

TABLE OF CONTENTS

PREFACE		iv
ACKNOWLEDGMENTS		v
CHAPTER I.	PURPOSE	1
CHAPTER II.	SETTING, FACILITIES, PHYSICAL FEATURES, SAMPLE	4
CHAPTER III.	PROCEDURES	7
CHAPTER IV.	COSTS	12
CHAPTER V.	TEACHER VARIABLES	20
CHAPTER VI.	PUPIL VARIABLES	43
CHAPTER VII.	PUPIL ACHIEVEMENT	58
CHAPTER VIII.	PARENTAL REACTIONS	68
CHAPTER IX.	SUMMARY AND CONCLUSIONS	71
CHAPTER X.	RECOMMENDATIONS FOR FURTHER STUDY	74
	APPENDIX A	
	APPENDIX B	
	APPENDIX C	
	LIST OF REFERENCES	

CHAPTER I

PURPOSE

Today, whether we Americans like it or not, accept the fact or not, we live in a thermo-nuclear age. There are in this world powers and nations whose way of life is utterly inimical to that of our own; powers who have stated as matters of national policy that they would "bury" us. This means that the possibility exists that our nation may (we trust never!) be subjected to nuclear attack. As one means of insuring the Nation's survival, the Office of Civil Defense has urged construction of fallout shelters, shelters that afford protection to the citizenry against radioactive fallout. The costs of providing adequate shelter space for all, or even a significant minority, are staggering. One possible solution, or partial solution, is to construct public and government buildings with two purposes in mind: the fallout shelter function, and the organization function. An obvious consideration for such treatment would be the public schools, since few communities have been able to pause in the construction of new schools as they strive to catch up with burgeoning population growth.

That these issues are urgent and current can be readily documented. For this purpose, a few excerpts from a recent Congressional hearing are given:

> There should be enough shelters all over the country where police, medical, and other emergency units can be protected. The shelter program, moreover, should be a nation-wide one (Hearings, No. 11, Part I, p. 3116).
>
> If a shelter meets the requirement of protecting against radioactive fallout, can it also be used, when it is not

being used for shelter purposes, as a classroom, an auditorium, a gymnasium, etc.?

One hundred and four million shelters are needed. Only 60% of the people at the present time are protected. It will take over 20 years to build 104 million shelters, and only 70 to 75 million are going to be usable (Hearings, No. 22, Part III, pp. 5620, 5671).

(Fallout shelters) give the American people some feeling of security. (They) are also a very effective protection.

From a psychological point of view, home shelters are preferable, because they will not cause anxiety in children, while school shelters would.

Are operational costs for this underground school considerably higher than for a regular school building?

We feel that it would be a great mistake to place shelters in school and create a kind of atmosphere which will put the children into a fear status (Hearings, No. 20, Part II, Vol. 1, pp. 3607, 3693, 4288, 4471).

These questions and remarks indicate several things. First, we need more fallout shelters. Second, serious questions have been raised concerning the advisability of using the school to serve in the dual capacity of both school and fallout shelter. It was to this latter issue that the present research was directed.

HYPOTHESES

Succinctly, the purpose of this investigation was to determine whether pupils attending a school-fallout shelter suceed as well as their brethren who are enrolled in conventional schools. Or to put it another way, were there any measurable, harmful effects that could be attributed to attending an underground school-fallout shelter? Consequently, the major hypothesis tested in this study

was that there are no significant differences in educational outcomes (overall achievement, emotional stability, physical health, and attitudes) among pupils in conventional, windowless, and underground schools.

This major hypothesis was divided into six sub-hypotheses:

H_1: There are no differences in operational costs between an underground school and conventional schools.

H_2: Teachers' attitudes and opinions are the same in an underground school as in conventional schools.

H_3: Pupils' measured anxiety in an underground school is not different from pupils' anxiety in conventional schools.

H_4: Attendance rates are the same between pupils in an underground school and conventional schools.

H_5: Pupils' achievement is not related to the type of school attended, underground vs. conventional.

H_6: Parents whose children attend an underground school possess attitudes toward school that are comparable to attitudes of parents whose children attend conventional schools.

CHAPTER II

SETTING, FACILITIES, PHYSICAL FEATURES, SAMPLE

Abo school is an elementary school containing 18 classrooms and supporting facilities, and, with the exception of its entrance, is built completely underground. Abo school takes its name from the Empire Abo Oil Field, and is located in Artesia, New Mexico.

Artesia, a town of about 13,000 people, is situated in the southeastern part of New Mexico. Its major industries include the production of cotton, alfalfa and livestock, processing and trading cotton, and the production and refining of gas, oil, and potash. The landscape is flat. Farming is done through irrigation. The temperature gets very high in the summertime, and dust storms are common. The Artesia School District serves some 18,000 people.

In an effort to combat the problems of dust and extreme temperatures, a local architect, Mr. Frank Standhardt, began experimenting with the concept of windowless schools. One such building (Yucca Elementary School), an above-ground, windowless school, has been built in Artesia. The step from an above-ground windowless building to one built completely underground is obvious, especially when, in addition to its regular function, the building is intended to serve as a fall-out shelter.

This, then, is Abo School--an elementary building containing about 30,000 square feet, built completely underground, and containing those additional facilities and provisions which enable

it to serve as a fall-out shelter in time of emergency. Abo school is topped with an insulated concrete slab 21 inches thick. Seven-eighths-inch steel doors, weighing 1,800 pounds each, can be bolted shut in a crisis. One hundred and forty tons of steel and 4,000 cubic yards of concrete were used in its construction.

Completed on April 20, 1962, Abo school is first in America and so far as it is known, first in the world to double as a fall-out shelter. It is built to accommodate up to 540 students, and 2,000 or more people when used in a disaster.

Three other schools from the Artesia System were also included in this research: Yucca Elementary School, which is above-ground and windowless; and Central and Hermosa Elementary Schools, which are conventional, windowed structures.

In September, 1964, a new Junior High School will begin operation in Artesia. This school is built on two levels--one completely below ground and the other above-ground and windowless.

Thankfully, Abo school has never had to serve as a fall-out shelter for an atomic attack. However, in June of 1964, the town of Artesia experienced a flash flood which brought four feet of water into homes in certain sections of the town. Hundreds of people who were homeless took refuge in Abo school until the water level receded. The effectiveness with which Abo school served in this disaster is being evaluated at the time of this writing.

It was felt that for the purpose of testing certain hypotheses in the study, pupils and teachers from schools outside the community

of Artesia should be included. For this purpose the researchers chose two Nevada School Systems--one which in this report we shall call Nevada I, and the other which we shall call Nevada II. Nevada I has a population of 10,500, and its chief industries include gaming and tourism. Nevada II has a population of 3,500. Tourism, government, and ranching are its major industries.

All three communities used in the research represent rather typical western towns. They serve a large rural area surrounding the town, and have some light industry. Tourism is more important in the Nevada communities than in Artesia.

CHAPTER III

PROCEDURES

The major portions of the study were undertaken in Artesia, New Mexico. The procedures involving these schools are related in detail, whereas the Nevada aspects, being routine, are discussed but briefly. The various steps and rationales for year one (1962-63) are presented separately from those of year two (1963-64).

Fall, 1962

The Stanford Achievement Tests were given to pupils in grades 4, 5, and 6. This was a routine, annual event. These data served as benchmarks from which subsequent pupil gains were measured.

Spring, 1963

The Stanford Achievement Tests were repeated in May. A variety of non-cognitive elements were studied, especially the domain of anxiety. To this end, Sarason's "Test Anxiety Scale for Children," and his "General Anxiety Scale for Children" (Sarason, 1960), were given in spring. Much effort was devoted to reassuring the community of the harmlessness of these tests; radio, press, and public meetings were held to allay suspicions. The possible consequences upon the obtained scores is indeterminate. However, it seems reasonable to assume that whatever the effects, they were randomly distributed among the four schools.

During this period, the teachers were asked to respond to three instruments, Taylor's "A Personality Scale of Manifest Anxiety" (Taylor, 1953), Holemon's scales for measuring attitudes toward parents, the career of teaching, and school policy and administration (Holemon, 1963), and Moeller's "Sense of Power" test (Moeller, 1962). The teachers' personnel records were examined to find whether or not significant differences existed between teachers in the different schools in variables such as age, experience, etc. Finally, the pupils were given an opportunity to react to the Morse Classroom Behavior Questionnaire (Morse, 1961). This scale purports to measure classroom social structure, attitude toward learning, and the child's perception of himself in the learning situation.

The purpose of these various measures was to determine the degree to which the various school populations were comparable, i.e.: were Abo pupils and faculty "different" from the pupils and faculties in the other three schools at the outset of the experiment? It would have been desirable to continue with the anxiety testing in order to learn whether or not anxiety increased or decreased with time, particularly in the Abo group, but the community climate was not propitious for further study in this dimension.

Beginning in November, and concluding in January of 1964, a sample of 24 parents was drawn from each of the four schools. This stratified random sample of 96 represented parents of pupils in grades 1, 4, and 6. The sample was reached by telephone, when

possible, and the responses to a structured interview recorded by the interviewer. Those without telephones were called upon at their homes. Seven parents were dropped without replacement after failure to reach them by four telephone attempts and three home calls. The interview attempted to ascertain parental attitudes toward "undergroundness" as a suitable educational environment.

Spring, 1964

The pupils were tested again with the Stanford Achievement Tests. A questionnaire was devised and given to all of the teachers, as was the Edwards Personal Preference Schedule (Edwards, 1959). The latter was given on a voluntary basis (well, not entirely: a bonus of $5.00 was offered to teachers who would take the test). The questionnaire estimated teachers' attitudes toward "undergroundness."

At the close of the school year, attendance records were obtained so the four schools could be compared. "Average Daily Membership" and "Average Daily Attendance" data were obtained, since comparisons between these two sets of indexes afford an estimate of the absence rates of these schools. Presumably, schools with higher attendance rates have children who are healthier than those in schools having lower rates, other factors being equal.

It was during this period that the achievement test data and the Edwards Personal Preference Schedule scores were obtained from a sample of teachers in two school systems in rural Nevada. The

first part of the data was gathered with the support of a grant from the University of New Mexico's Faculty Research Committee. As these data were analyzed, their relevancy to the Abo project became strikingly apparent: an opportunity was at hand to determine effects as well as to make it possible to generalize the Abo findings beyond the town of Artesia.

In May, cost data were collected from the records of the Business Manager of the Artesia School System. Overall expenditures for electricity, gas, custodial supplies and hours worked by custodians were recorded for Abo, Hermosa, and Yucca schools. These data made it possible to compare certain costs of operation of these three schools.

Parenthetically, it should be noted that the New Mexico Optometric Association expressed an interest in studying the effects of these unique school environments upon pupils' vision. They devised a longitudinal study to extend over three years. A team of optometrists measured several indexes of vision; all fourth grade pupils were checked during a February examination session. The results of this work are not presently (August, 1964) available.

Summary of Procedures

During the first year, pupils in grades 4, 5, and 6 of Abo (underground), Central, Hermosa and Yucca (windowless) schools were given fall and spring achievement tests. Measures were taken of teachers, pupils, and parents in the noncognitive areas of anxiety,

attitude, or opinion. Finally, certain teacher characteristics, e.g., age, experience in teaching, etc. were analyzed.

The second year, 1963-64, continued the program of fall and spring achievement tests. Teachers' opinions on school environments were obtained, as were scores on the Edwards Personal Preference Schedule. Comparable personality and achievement test data were obtained from two school systems in Nevada. Cost-of-operation data were collected for Abo, Hermosa, and Yucca schools.

CHAPTER IV

COSTS

The major areas of cost data were examined: those pertaining to expense of building a school underground as compared to a conventional school, and those pertaining to the expenses of operating the schools throughout the school year. These latter included such items as electricity, gas, janitorial service, etc.

Costs of school construction, operation, and maintenance vary greatly from one part of the country to another. The reader is reminded that the cost data presented here are for Artesia, New Mexico, and were gathered during the two year period of this research.

Capital Outlay

The cost of building a conventional type school structure in Artesia, New Mexico, has been estimated to be $11.44 per square foot. The cost of a building above ground but windowless has been estimated to be $12.56 per square foot. The cost of an underground building, such as Abo, has been estimated to be $13.85 per square foot, or an increase of 21% over conventional structures. This latter figure includes the cost of those additional facilities which make an underground school also capable of serving as a fallout shelter (Board of Education).

Operation

For the purpose of comparing operational costs, three of Artesia's elementary schools were used--Abo, the underground school, Yucca, the above-ground, windowless school, and Hermosa, conventional, windowed-type building. All three buildings were designed by the same architect, Mr. Frank Standhardt, of Roswell, New Mexico. Information relative to size of the three schools is summarized in Table 1. (Central School was excluded from this analysis because of its venerable age.)

Table 1 shows that Abo School had a gross cubage of 408,959 cubic feet; which was between the larger Hermosa School and the smaller Yucca School. We see, too, that Abo yielded a somewhat smaller net cubage, as well as the smallest square footage. This school has a somewhat higher pupil density as shown by its A.D.M. of 662, which was larger than the other two schools.

A record was kept of the amount of time each building was used for purposes not related to the regular educational program. Costs were prorated to include only those related to the regular program. Figures are based on the period from September 1, 1963 to May 31, 1964.

Records were kept by the business office of the Artesia Public Schools on the costs of electricity, gas, and custodial services and supplies. (The cost of water was not included, because it was found that water usage varied extensively depending upon the size of the school site and the amount used in maintaining lawns.) Summaries of cost data appear in Tables 2, 3, and 4.

Table 1

Size of Schools

School	Gross Cubage*	Net Cubage**	Square Footage	A.D.M.***
Abo	408,959	277,614	29,851	462
Hermosa	440,832	310,840	30,397	380
Yucca	341,427	279,318	29,397	329

*Gross Cubage includes outside to outside wall to top of roof.

**Net Cubage includes all open space--inside wall to inside wall to ceiling.

***A.D.M. = Average Daily Membership 1963-64 school year.

Table 2

Costs of Electricity

1963-1964 School Year

School	Cost per sq. ft.	Cost per pupil in A.D.M.
Abo	$ .0987	$6.31
Hermosa	.0165	1.32
Yucca	.0756	6.76

Note.- The electricity rate varied from 1.94¢ per kilowatt down to 1.25¢ per kw, depending upon the amount of electricity used.

Table 3

Costs of Gas

1963-1964 School Year

School	Cost per cubic ft.	Cost per pupil in A.D.M.
Abo	$ .0015	$ .92
Hermosa	.0027	2.21
Yucca	.0014	1.21

Note.- The rate paid for gas was 36¢ per 1000 cubic feet.

Table 4

Custodial Services - 1963-64 School Year

School	Man Hours	Cost	Cost per sq.ft.	Cost per pupil in A.D.M.
Abo	1440	$4,297.50	$ .0144	$ 9.30
Hermosa	2160	5,157.00	.0170	13.56
Yucca	1440	4,297.50	.0146	13.06

Table 2, "Costs of Electricity," shows that both windowless schools, Abo and Yucca, used more electricity than the conventional school, Hermosa. A note is in order regarding the comparison of the quality of lighting between the windowless schools and conventional schools. In the windowless buildings (Abo and Yucca), the lights are in operation whenever the building is occupied so the children are assured of adequate light at all times. In the conventional building (Hermosa), teachers are free to decide when the natural light is so inadequate that the artificial lights should be used. Visits to these rooms by the researchers showed wide variation in the judgment of individual teachers. On the basis of light meter readings, there were many instances when artificial lights should have been used but were not.

Table 3, "Costs of Gas" shows that the two windowless structures were more economical to heat than the conventional building. This appeared with both indexes applied: cost per cubic foot of space, and cost per pupil.

Table 4 shows that Abo School cost considerably less for custodial services on a per pupil basis. The cost for custodial services on a per square foot basis showed that the two windowless structures were less expensive than the windowed school.

The cost of supplies could not be treated quantitatively for several reasons. First, Abo School, being new, had to be stockpiled with a variety of supplies: cleaning compound, brooms, and the like. Second, it was found that custodians vary considerably in their use of these supplies, i.e., some wax a floor

weekly, while others do so less often. These variations did not seem to be a function of the structure.

Maintenance

The omission of maintenance costs in this report is not an oversight. Abo School has been in operation for only two years, and any maintenance cost comparison based on so short a period would be of little significance. It must be realized that many maintenance costs do not begin to appear until a building has been in use five or more years.

However, it seems realistic to assume that the maintenance costs of Abo School over a long period of time will be considerably less than for a comparable structure of conventional type. In an underground school there is no window breakage or window washing. There is practically no exterior painting, and there is no maintenance or replacement of window shades or other devices used for controlling natural light. The 21-inch thick concrete roof will obviously function for the life of the structure without replacement or repair.

Summary

In summary, it can be seen that the Abo School cost somewhat more to build at the outset, but that this increase cost permitted the installation of a number of extra features, such as air filters. Abo School's expenses for lighting were comparable to those of the windowless school, Yucca. The heating costs in both of these schools were considerably less than in the conventional school. The costs for custodial services were somewhat less in the Abo School.

CHAPTER V

TEACHER VARIABLES

A crucial element in any child's learning environment is the teacher. Although the relative importance of physical factors vs. those of teachers is unknown, there is reason to believe that the latter factor is indeed significant. Consequently, in a study which focuses primarily upon the physical factors within the environment, it becomes imperative to examine the nature of the teacher variables. How to control the teacher variable is a vexatious problem that has not been solved to the satisfaction of researchers. In this study, the factor might have been controlled by having teachers actually teach for certain periods of time in each of the several physical environments. Unfortunately, as is often the case, this elegant procedure was impractical. In its stead, we examined several relevant, noncognitive variables, as well as certain teacher characteristics. The basic hypothesis in each case was that the Abo teachers were not significantly different from the teachers in the other three schools (and subsequently, in two Nevada schools as well). A finding that Abo teachers were similar to the other teachers in the study would tend to lend credence to the conclusion that the Abo pupils encountered a teaching faculty that was comparable to that of pupils in the other schools. This analysis considered three areas: teacher characteristics as described in their personnel files, anxiety as measured by one of Taylor's

instruments, and measures of various attitudinal-personality scales.

Teacher Characteristics

The teachers' personnel files offered data on the following points: age, education, experience, marital status, sex, and advanced degrees. Prior researchers have felt that these elements may or may not affect teacher effectiveness (Getzels & Jackson, 1963, pp. 568 ff.). Means and percentages of teacher characteristics appear in Table 5, "Teacher Characteristics."

Table 5 shows that there was a tendency for the Abo teachers to be slightly younger with their mean age of 41.9 compared, for instance, with the mean age of 43.1 for Yucca teachers; that they had somewhat more education, but less experience. Each of these variables was tested by analysis of variance, and no differences reached the 5% level of significance. As an illustration, Table 6, "Analysis of Variance for Age," is reported. The low *F* of 0.85 lacks significance.

From Table 6, and from comparable data computed but not here reported in the interest of brevity, it was concluded that the teachers of the four schools were pretty much alike with respect to age, credit hours, advanced degrees (M.A. and above), years of teaching experience, marital status, and percentage of males. Any differences were regarded as fluctuations due to chance, rather than to systematic bias.

Table 5

Teacher Characteristics

	Variable						
School	No. of teachers	Mean age	Mean credit hours	% with M.A. or above	Years exper.	% Single	% Males
Abo	17	41.9	153.6	53	14.4	18	29
Central	16	47.2	147.1	28	16.7	19	25
Hermosa	19	46.2	149.7	47	16.0	11	26
Yucca	15	43.1	144.5	47	16.7	13	20

Table 6

Analysis of Variance for Age

Source	df	Sum of squares	Mean square	F*
Between schools	3	308.57	102.86	.85
Within	61	7,408.84	121.46	
Total	64	7,717.41		

*No significant difference in F Ratio

Teacher Anxiety

Taylor's "A Personality Scale of Manifest Anxiety" was administered to the teachers during the spring of 1963. Although the literature on the effects of anxiety upon the learner is growing, little has been offered regarding the effects of anxiety upon teachers. That is, the relation between teacher anxiety and pupil behavior has not received much research attention. However, for our purposes, it was sufficient to determine whether or not the teachers in the four schools were comparable on this variable. It would have been most interesting to follow anxiety as a function of time and environment, and to follow the relations of teacher anxiety to pupil behavior; this must remain for future researchers. As mentioned earlier, the first project was infeasible due to unfavorable community climate, and the second was outside the realm of this study.

The results of the Taylor test appear in Table 7, "Taylor's Anxiety Scales: Means and Standard Deviations by Schools." The table shows that although there were slight variations in anxiety scores from school to school, these differences did not reach statistical significance; the observed differences can be regarded as chance variations, rather than systematic differences between schools ($F = 0.2$, which lacks significance at the 5% level).

Table 7

Taylor's Anxiety Scales: Means and

Standard Deviations by Schools

Variable	School			
	Abo	Central	Hermosa	Yucca
Number of teachers	17	18	17	15
Mean	8.59	9.06	9.67	8.17
S.D.	5.54	4.83	5.46	5.83

Analysis of Variance

Source	df	Sum of squares	Mean square	F*
Between schools	3	20.3	6.8	0.2
Within schools	63	1,958.9	31.1	
Total	66	1,979.2		

*No significant difference in F Ratio.

Teacher Attitudes

Two measures were employed in an attempt to determine whether or not the Abo teachers differed significantly from their colleagues in their attitudes. Holemon (1963) has offered evidence that his scales possess reasonable reliability and validity. This instrument measures attitudes toward parents, the career of teaching, and administrative rules and procedures. In addition, Moeller's "Sense of Power" scale was administered. In his usage, sense of power refers to the degree to which the teacher feels that she has the professional autonomy to function adequately in the classroom and school environment.

The data from these attitude inventories appear in Table 8, "Mean Scores of Teachers' Attitudes, by Schools." Cursory examination of the table suggests that these teachers are indeed homogeneous with respect to the variables assessed by the two sets of scales. The more exact tests afforded by analyses of variance support the visual impression: the small differences fail to approach statistical significance.

We concluded that the Abo teachers were not unlike their colleagues in Central, Hermosa, and Yucca schools with respect to this batch of variables.

A questionnaire was sent to all classroom teachers in the four Artesia schools. The teachers were asked to give their opinions concerning certain school environmental variables. The responses to the questionnaire are reported in Table 9.

Table 8*

Mean Scores of Teachers' Attitudes, by Schools

	Abo (n=17)	Central (n=18)	Hermosa (n=17)	Yucca (n=15)	F**
Holemon Scales:					
Attitude toward parents	26.1	27.2	26.5	26.1	0.32
Attitude toward teaching career	31.5	30.5	31.7	31.7	0.49
Attitude toward school administration and regulations	26.0	25.3	24.4	24.9	0.64
Moeller Scale:	(n=16)	(n+18)	(n=16)	(n=15)	
Sense of power	22.0	21.1	22.7	21.4	0.74

*The analyses of variance for this table appear in Appendix A.

**No significant difference in F Ratios.

Table 9

Response to Teacher Questionnaire

of May, 1964

1. Sixty-one teachers responded to the questionnaire as follows:

Abo	18
Central	15
Hermose	15
Yucca	13

2. In which grade do you teach?

	Grade						
School	1	2	3	4	5	6	(music, etc.)
Abo	3	2	3	3	3	3	1
Central	3	2	2	2	2	4	0
Hermosa	3	3	1	2	2	2	2
Yucca	2	3	1	2	1	3	1

3. How many years have you taught in this building?

	Years				
School	1	2	3	4	5 or more
Abo	7	11	0	0	0
Central	2	3	1	1	7
Hermosa	2	1	2	0	9
Yucca	1	2	1	3	6

(Table continued on next page)

Table 9 (continued)

4. How do you feel about having windows in the classroom?

School	Response: Helpful	Doesn't matter	Hindrance
Abo	1	5	12
Central	7	6	2
Hermosa	8	4	3
Yucca	2	4	6

5. Do windows contribute to your personal comfort in the classroom?

School	Response: Yes	No	Doesn't matter
Abo	0	13	5
Central	8	3	4
Hermosa	7	6	2
Yucca	2	10	1

6. How do you feel about teaching in an underground school?

School	Response: Like	Don't know	Dislike
Abo	18	0	0
Central	2	12	1
Hermosa	6	6	3
Yucca	11	2	0

(Table continued on next page)

Table 9 (continued)

7. How do you feel about teaching in an above ground, windowless school, such as Yucca?

	Response		
School	Like	Don't know	Dislike
Abo	13	5	0
Central	3	10	2
Hermosa	5	8	2
Yucca	13	0	0

8. How do you feel about the pupils learning in an underground school?

	Response		
School	Adversely affected	Little difference	Better this way
Abo	0	8	10
Central	0	13	1
Hermosa	0	10	4
Yucca	0	9	4

9. Have you taught in a school with windows?

	Response	
School	Yes	No
Abo	7	1
Central	15	0
Hermosa	14	1
Yucca	13	0

(Table continued on next page)

Table 9 (continued)

10. How do parents feel about an underground school?

	Response		
School	Good idea	Poor idea	Don't know
Abo	12	0	6
Central	2	0	12
Hermosa	6	0	8
Yucca	3	0	10

The table shows that those who taught in either an underground or windowless school preferred this arrangement. Those teaching in conventional schools either preferred this type of building, or else, were not sure.

The teachers in Abo and Yucca feel that windows are a hindrance and fail to contribute to their comfort (items 4 and 5). This opinion was not shared by Central and Hermosa teachers.

In similar fashion, Abo and Yucca teachers reacted more favorably toward teaching in either an underground or windowless school. Central and Hermosa teachers felt that they did not know (items 6 and 7). Abo teachers were more inclined to feel that pupils learn better in an underground school. The other teachers were less enthusiastic (item 8). Abo and Hermosa teachers tended to the opinion that parents favored underground schools. Neither Central nor Yucca teachers shared this opinion to the same degree (item 10).

The Edwards Personal Preference Schedule

Although the effects of teacher personality upon children are not well understood, there is considerable feeling that such relationships do exist (Redl & Wattenberg, 1959). Acceptable methods for assessing personality are a matter for heated controversy. The Edwards Personal Preference Schedule (EPPS) purports to measure certain basic psychological needs as elaborated by Murray (Murray, 1938) and his students (Edwards, 1959).

If groups of teachers between schools are not strikingly dissimilar on various measures of noncognitive aspects, one has reason to believe that these groups tend to be alike in their effects upon pupils, whatever these effects might be. If one finds similarities in noncognitive aspects, then whatever differential effects are observed in the school are less likely to be due to teacher personality. The point that we are making is simply this: was Abo School staffed by paragons, by neurotics, or maybe, neither?

The same considerations apply as we consider schools other than Artesia. Was the Artesia system staffed by teachers who were unique? If this were true, the external validity of the study would be seriously jeopardized. If, on the other hand, the Artesia teachers were found to be a part of the mainstream of American teachers, then the possibilities for generalizing are correspondingly increased.

The EPPS was given to these Artesia teachers in grades 4, 5, and 6 who volunteered to take it (and to accept a token payment of $5.00 for the out-of-school time required). While 19 teachers participated, six did not. These six came primarily from one school, Yucca. The test was also given to a sample of teachers from the two Nevada communities described earlier. The Nevada samples were chosen on the basis of having taught in the school for at least two years, and assignment to grades 4, 5, or 6. These criteria were employed to maximize the comparability of these samples with tnat

drawn in Artesia. All teachers save one appeared for the test (she was ill).

The Abo teachers were compared with the other Artesia teachers in Table 10. The table shows few surprises. The various means and standard deviations for the two groups are similar, with the exception of the "Need for Intraception." The Abo teachers' mean of 17.9 was significantly higher than the 15.2 mean obtained by teachers of Central, Hermosa, and Yucca schools. However, this finding must be interpreted with caution. In establishing Table 10, it was necessary to compute no less than 16 *t* ratios. It is well known in statistical circles that the greater the number of statistics we compute, the greater the likelihood of finding significance, even though none exists. As a consequence, it seems reasonable to note that a significant difference was found on only one of the 16 scales; it may be that the Abo teachers possess empathy to a somewhat higher degree than do their colleagues in the other schools. More data are needed in order to substantiate this conclusion. The data in Table 10 lead to the conclusion that the Abo teachers obtained scores on the EPPS that were comparable to those obtained by their peers in Central, Hermosa, and Yucca schools. We concluded further that these teachers did not differ significantly in the aspects of personality measured by this test.

We now turn to the comparisons between the Artesia teachers and similar (in tenure and grade taught) teachers from two school systems in Nevada. These comparisons appear in Table 11, "The

Edwards Personal Preference Schedule: Comparison Between School Systems." The table shows, for example, that 19 Artesia teachers obtained a mean score of 16.2 on the EPPS scale of "Achievement". This did not differ significantly from the mean of 14.1 of Nevada I and 13.7 of Nevada II. The F of 1.6 lacks significance at the 5% level; we concluded, therefore, that the teachers from these three school systems answered the questions relating to this scale in pretty much the same way. The standard deviations (SD) of 4.0, 4.6, and 4.0 suggest that variability within the three groups was also comparable.

Table 11 reports 2 significant F ratios. Both Artesia and Nevada I teachers scored higher than did Nevada II teachers on the need for "Exhibitionism." The Artesia teachers scored higher on the need for "Dominance" than did either Nevada group.

The most striking feature of Table 11 lies in the close similarities between these three groups of teachers. The data suggest that except for minor differences, these three groups were alike. This finding is quite important. It persuaded us to believe that the educational experiences received by pupils in the Artesia setting were not the result of a unique corps of teachers. Granted, the total number of teachers available for purposes of comparison was limited. Nonetheless, it seems reasonable to predict that the addition of more school systems similar to those we have studied would not vitiate our finding, which was that the Artesia teachers were not a group apart.

Table 10

The Edwards Personal Preference Schedule:

Abo Teachers vs. Other Artesia Teachers

Need	Abo (n=8)	Other Artesia Teachers (n=11)	t*
Achievement			
M	15.1	17.0	1.04
S.D.	3.5	3.9	
Deference			
M	14.8	14.9	.12
S.D.	2.9	2.9	
Orderliness			
M	13.1	14.1	.69
S.D.	3.3	2.0	
Exhibitionism			
M	12.1	12.2	.03
S.D.	2.8	4.3	
Autonomy			
M	12.0	12.2	.10
S.D.	3.3	4.2	
Affiliation			
M	15.2	15.4	.11
S.D.	3.5	4.4	

(Table 10 continued)

Table 10 (continued)

Need	Abo (n=8)	Other Artesia Teachers (n=11)	t*
Intraception			
M	17.9	15.2	3.03
S.D.	1.9	1.5	
Succorance			
M	11.0	10.3	.44
S. D.	3.2	3.5	
Dominance			
M	15.8	18.6	1.32
S.D.	3.4	5.6	
Abasement			
M	14.1	12.0	.83
S.D.	5.7	4.5	
Nurturance			
M	14.9	16.5	.76
S.D.	4.0	5.2	
Change			
M	16.2	13.4	1.05
S.D.	4.3	7.1	
Endurance			
M	14.8	16.2	.94
S.D.	3.0	3.2	
Heterosexuality			
M	10.8	9.2	.61
S.D.	11.9	10.6	

(Table 10 continued)

Table 10 (continued)

Need	Abo (n=8)	Other Artesia Teachers (n=11)	t*
Aggression			
M	11.8	12.8	.81
S.D.	2.0	3.4	
Consistency			
M	10.6	11.9	1.44
S.D.	1.7	1.9	

*No significant differences in t Ratios.

Table 11

Edwards Personal Preference Schedule:

Comparison Between School Systems

Variable	Artesia (n=19)	Nevada I (n=19)	Nevada II (n=10)	F
Achievement				
M	16.2	14.1	13.7	1.6
S.D.	4.0	4.6	4.0	
Deference				
M	14.8	15.8	16.1	.7
S.D.	2.6	3.4	3.2	
Orderliness				
M	13.7	14.0	15.3	.3
S.D.	5.3	6.0	3.9	
Exhibitionism				
M	12.2	13.1	8.8	3.7*
S.D.	3.8	4.5	3.8	
Autonomy				
M	12.1	12.8	12.2	1.8
S.D.	4.0	4.3	3.2	
Affiliation				
M	15.4	16.2	18.0	1.4
S.D.	4.2	4.0	4.3	

(Table 11 continued)

Table 11 (continued)

Variable	Artesia (n=19)	Nevada I (n=19)	Nevada II (n-10)	F
Intraception				
M	16.4	14.9	16.1	.7
S.D.	3.7	3.7	4.1	
Succorance				
M	10.6	12.0	9.1	1.8
S.D.	3.5	4.4	4.3	
Dominance				
M	17.4	13.4	11.4	4.6*
S.D.	5.1	5.5	6.1	
Abasement				
M	12.9	13.9	17.2	2.9
S.D.	5.3	4.2	3.9	
Nuturance				
M	15.8	15.8	15.8	less than .1
S.D.	4.9	4.2	5.4	
Change				
M	14.6	16.2	18.9	2.0
S.D.	6.4	5.0	4.8	
Endurance				
M	15.6	17.5	18.1	1.7
S.D.	3.3	4.6	4.0	

(Table 11 continued)

Table 11 (continued)

Variable	Artesia (n=19)	Nevada I (n=19)	Nevada II (n=10)	F
Heterosexuality				
M	12.2	7.5	9.0	1.3
S.D.	12.7	5.2	6.8	
Aggression				
M	13.3	12.2	10.0	1.6
S.D.	5.0	4.0	5.0	

* F Ratio significant at 5% level.

Note.- See Appendix B for analyses of variance.

Summary of Teacher Variables

Recognizing the critical importance of the teacher in the learning environment, we attempted to determine whether Abo teachers were like their colleagues, both in Artesia and in 2 school systems in Nevada. These measures were prompted by 2 prime considerations:

1) The internal validity of the study would be threatened seriously if the Abo teachers possessed unique qualities. It would be difficult, if not impossible, to disentangle teacher effects upon pupils from environmental effects.
2) The external validity of the findings would be enhanced if it were found that the Artesia schools in general were staffed by teachers similar to their peers in other school systems.

Three areas were investigated: personnel data (age, experience, etc.), attitudinal factors, and scores on the Edwards Personal Preference Schedule (a paper and pencil type of personality test). It was concluded that the Abo teachers were comparable to their colleagues in Central, Hermosa, and Yucca schools. And it was further concluded, on the basis of the Edwards Personal Preference Schedule, that the Artesia teachers had much in common with their peers in other school systems.

Consequently, the findings from the Abo School and the Artesia system are likely to have implications for other schools in other states.

CHAPTER VI

PUPIL VARIABLES

The crux of this study of environmental factors and their effects upon learning is, of course, the pupil. The effects upon teachers, parents, costs, etc. must take second place to the effects upon the pupils. Under this rubric, certain noncognitive variables were examined. They included anxiety, attendance, vision, and attitudes toward school.

Attitudes Toward School.

Portions of the Morse Pupil Classroom Behavior Questionnaire, (Morse, 1961), were used to collect data about the pupils' classroom behaviors. The instrument is a paper and pencil type test; it was administered by the one trained examiner to all groups in all schools. The inventory included areas of measurement in classroom social structure, educational index and pupil acceptance. A brief description regarding each of these areas should prove useful.

The "classroom social structure" area included items determining the degree of friendliness of the respondent toward his classmates and his perception of the friendliness of his classmates toward himself. An example of such questions follows:

A. Some classes are very friendly and others are not. How friendly are the pupils in this class toward you?

1. Classmates are very friendly toward me.

2. Classmates are pretty friendly toward me.

3. Classmates are a little friendly to me.

4. Classmates are not friendly at all to me.

The area measured by the "learning index" included questions designed to measure the respondent's perception of his own motivation and his ability and desire to do the work in the classroom. It included questions such as:

A. Do you know for sure exactly what work you are supposed to do?

B. How often do you like the work in this class?

C. How often do you really want to do the work in this class?

Pupils responded to these questions on an eight point scale.

The area of pupil acceptance was taken from Morse's original Mental Health Index. This pupil acceptance index was comprised of the questions which remained after removing the anxiety questions from the Morse Mental Health Index, (anxiety was measured separately and is discussed subsequently). The "pupil acceptance index" measured the pupil's acceptance of the teacher and his perception of the teacher's acceptance of himself.

Pupils responded on a four point scale to such questions as:

A. I think of the teacher as a good friend.

B. I think of the teacher as a person who gets angry.

C. I think of the teacher as a person who picks on me.

D. I think of the teacher as a person with whom I like to talk when I feel unhappy.

The results from these tests appear in Tables 12, 13, and 14. Table 12, "Morse Learning Index: Schools and Grades" shows that significant differences existed between certain of the schools at certain grade levels. The differences between schools at the 4th grade level may be attributed to chance. No so in grades 5 or 6. In grade 5, Central School's mean of 57.55 was significnatly lower than Yucca School's mean of 65.94. Abo pupils fell between these extremes. In grade 6, Yucca's mean of 55.94 was lowest; the highest mean of 62.93 was obtained by Hermosa pupils. Again, Abo was in-between.

Table 12

Morse Learning Index:

Schools and Grades

Grade	N	Abo	N	Central	N	Hermosa	N	Yucca	F
4th M	55	63.00	45	62.62	67	61.00	35	64.71	1.63
S.D.		8.88		6.42		9.12		7.76	
5th M	71	61.39	31	57.55	45	61.27	34	65.94	5.48*
S.D.		8.04		8.69		9.63		6.95	
6th M	76	57.30	45	60.24	53	62.23	32	55.94	6.30*
S.D.		8.13		5.81		7.76		9.19	

* F Ratio significant at 1% level.

Table 13

Morse Group Process

Grade		N	Abo	N	Central	N	Hermosa	N	Yucca	F
4th	M	55	21.98	45	21.27	67	22.28	35	23.17	2.65*
	S.D.		3.55		3.15		2.91		2.24	
5th	M	71	21.06	31	20.77	45	20.00	34	23.09	5.75**
	S.D.		3.28		3.30		3.69		2.97	
6th	M	76	20.59	45	21.51	53	21.45	32	20.97	1.30
	S.D.		2.76		2.51		2.54		4.38	

* F Ratio significant at 5% level.

** F Ratio significant at 1% level.

Table 14

Morse Pupil Adjustment

Grade		N	Abo	N	Central	N	Hermosa	N	Yucca	F
4th	M	55	58.60	45	56.69	67	55.90	35	61.74	4.15**
	S.D.		9.42		8.08		9.00		5.31	
5th	M	71	56.90	31	53.94	45	56.24	34	59.68	2.58
	S.D.		7.63		8.36		8.89		9.72	
6th	M	76	53.86	45	57.38	53	56.21	32	52.97	2.92**
	S.D.		8.99		6.33		7.59		8.28	

* F Ratio significant at 5% level.

** F Ratio significant at 1% level.

Differences are also apparent in Table 13, "Morse Group Process". Yucca's fourth grade mean of 23.17 was significantly higher than the mean of 21.27 posted by Central School. In grade 5, the sharpest difference appears between Yucca and Hermosa. The differences noted in grade 6 fail to reach statistical significance.

Pupil adjustment differed significantly between schools in grades 4 and 6, as disclosed in Table 14, "Morse Pupil Adjustment." These differences involve Yucca and Hermosa at the fourth grade level, and Yucca and Central at the sixth grade level. In each case, the Abo pupils' mean fell between these extremes.

The differences detected between schools do not appear to be systematic. Rather, they seem to suggest that certain pupils in certain grades responded differently to certain of the Morse scales. The Abo pupils tended to fall in-between the more clearly defined extreme positions. As a consequence, the conclusion seems justified that insofar as these scales were concerned, the Abo pupils were typical of other boys and girls, in Artesia.

Pupil Anxiety

One of the most serious criticisms of the plan to combine a fallout shelter with an elementary school was the fear of increasing pupil anxiety. Many persons felt that a fallout shelter, by its very nature, would inevitably increase anxiety levels in children, anxiety

levels detrimental to mental health and to learning. The point is well taken. Research has shown that high levels of anxiety exert a negative influence upon school achievement (Sarason, 1963), to say nothing of the negative effects of anxiety upon mental health in general (Davidson, 1959; Feldhusen and Thurston, 1964; Hammes, 1961).

A careful investigation of the effects of the Abo facility upon anxiety in its children would entail a series of anxiety measures over time, say systematic measures every 5 or 6 months. If comparable measures were obtained for pupils in other Artesia schools, it would be possible to determine the long term effects of school structure upon anxiety. Unfortunately, the type of investigation was not feasible. The community voiced grave doubts concerning the morality or pertinence of "personality" tests in their schools. Considerable public discussion ensued; it was finally agreed that such tests would be administered once, but no more. Consequently, the data we have secured represent a cross section of anxiety as it existed among pupils in the spring of 1963. The Abo pupils had, at this time, been exposed to the underground facility for 6 months.

The instruments employed to measure anxiety were two of Sarason's scales (Sarason, 1960): "General Anxiety Scale for Children", and "Test Anxiety Scale for Children" (both were reprinted with the publisher's permission).

These two scales purport to measure different kinds of anxiety; Sarason (1960) reports low correlation between the two tests, i.e., the two scales measure different kinds of anxiety. These scales seem to

possess adequate validity, both construct and empirical (Farnsworth and McNemar, 1960). The reliability of these tests has been variously reported as ranging from 0.55 to 0.79, with the average being 0.72 (Sarason, 1960, p. 103). It should be noted in passing that the "Test Anxiety Scale for Children" apparently measures more than just anxiety about tests; it seems to get at the child's generalized feelings of anxiety in the school situation (Dunn, 1963).

Table 15, "Sarason Test Anxiety by Schools and Grades" shows the various means, standard deviations, and F tests for grades 4, 5, and 6 in their respective schools. Significant differences in mean scores were noted at all three grade levels. In each case, however, the Abo pupils' means were toward the lower end of the distribution, showing lesser amounts of anxiety toward school. The table also shows that these differences persist when the pupils within each school are grouped and their mean scores compared. It seems clear that the fallout shelter failed to evoke the anxiety feared by earlier commentators.

Similar results were found when the "General Anxiety Scales by Schools and Grades" were analyzed. Table 16 shows that the Abo pupils' mean general anxiety scores fell consistently toward the lower end of the distribution, which lead us to conclude again that the factor of attending school in a fallout shelter did not adversely affect the pupils' levels of general anxiety.

Table 15

Sarason Test Anxiety by Schools and Grades

Grade		School				F
		Abo	Central	Hermosa	Yucca	
4th	N	55	45	67	35	
	M	12.0	16.2	16.2	16.2	3.14*
	S.D.	6.2	13.3	7.3	6.2	
5th	N	71	31	45	34	
	M	12.7	13.8	10.3	15.0	3.65*
	S.D.	6.7	5.9	6.8	6.9	
6th	N	76	45	53	32	
	M	12.7	13.0	12.0	17.5	5.09 **
	S.D.	6.6	7.0	6.1	7.1	
Combined Grades within Schools						
	N	202	121	165	101	
	M	12.5	14.4	13.3	16.2	5.97**

Analysis of Variance for Combined Grades within Schools

Source	df	Sum of Squares	Mean Square	F
Schools	3	1,001.10	333.70	5.97**
Within	585	32,721.71	55.93	
Total	588	33,722.81		

* F Ratio significant at 5% level.

** F Ratio significant at 1% level.

Table 16

Sarason General Anxiety Scales by Schools and Grades

Grade		School				F
		Abo	Central	Hermosa	Yucca	
4th	N	55	45	67	35	
	M	13.9	17.2	17.7	19.1	2.90*
	S.D.	9.4	8.6	8.8	9.4	
5th	N	71	31	45	34	
	M	13.0	14.8	11.6	15.1	1.69
	S.D.	8.0	7.6	7.3	8.1	
6th	N	76	45	53	32	
	M	13.6	15.5	13.4	16.1	1.32
	S.D.	7.6	7.3	8.3	8.9	
Combined Grades within Schools						
	N	202	121	165	101	
	M	13.5	16.0	14.6	16.8	4.38**

Analysis of Variance for Combined Grades within Schools

Source	df	Sum of Squares	Square	F
Schools	3	928.22	309.41	4.38**
Within	585	41,292.70	70.58	
Total	588	42,220.92		

* F Ratio significant at 5% level.

** F Ratio significant at 1% level.

The data presented in Tables 15 and 16 might well lend themselves to further study along the lines suggested by previous research, e.g., the extent to which anxiety was related to teachers' attitudes, school achievement and the like. Fascinating though these topics may be, they were deemed to fall outside of the scope of the present study; consequently, these problems remain for future investigators.

Attendance

It was deemed desirable to investigate the effects of the physical structures upon the pupils' health. Various physicians in Artesia and elsewhere were consulted; their consensus was that this would be a most complex and expensive undertaking, well beyond the resources of this investigation. As a substitute for a full-fledged analysis of health factors, it was decided to examine a consequence of ill health upon pupils, namely, attendance rate.

New Mexico schools are required by state regulations to maintain accurate attendance records as the basis for allocation of certain funds. The Artesia records were examined.

Two figures were used for each of the four schools included in the research. The first figure represents the average number of pupils enrolled in the particular school during a school year, (A.D.M. = average daily membership). The second figure represents the average number in attendance for the same school year, (A.D.A.= average daily attendance).

Table 17

Pupil Attendance by School and Year

Year		Abo	Central	Hermosa	Yucca
1962-63					
	A.D.M.	453.0	387.6	419.0	304.8
	A.D.A.	435.1	367.5	400.7	293.8
	x^2 = .03 (Not significant at 5% level)				
1963-64					
	A.D.M.	466.2	364.8	379.0	328.1
	A.D.A.	449.3	347.9	362.1	314.8
	X^2 = .02 (Not significant at 5% level)				

Consequently, the difference between those enrolled and those in actual attendance reflects the absence rate.

Two sets of figures are presented - one set for the school year 1962-1963, and the other for the school year 1963-1964.

Chi Square was used to test for significant difference in the attendance rates across the four schools. Table 17 shows that the differences lack significance. Therefore, it was concluded that school attendance during the two year period of this study was independent of type structure. The Abo pupils' attendance rate was similar to the rates in the other Artesia schools.

Vision

The New Mexico Optometric Association saw the desirability of studying the effects of school environments upon pupil vision. The Artesia staff and the research staff agreed that this was a variable meriting examination; it was also felt that such an analysis would afford an opportunity to explore the relationship between vision and achievement. The Association sent a team of optometrists into the schools during January 1964; all fourth grade pupils were examined. Unfortunately, the Association had not completed its analysis at the time of preparing this report, so little can be said of the matter. The Association does intend to carry on its studies for the next two years, which should permit an analysis of the long-term effects upon vision of windowless and/or underground environments.

Summary of Pupil Variables

This chapter has presented data upon several noncognitive areas of pupil behavior. In the fields of attitudes toward school, test anxiety, general anxiety, and pupil attendance, no data were found to support the notion that attending an underground school designed as a fallout shelter causes deleterious effects. On these measures, at least, the Abo pupils responded in the same manner as their peers attending other schools in Artesia.

The findings lend credence to the postulate that an underground school-fallout shelter affects its pupils in about the same way as conventional schools.

CHAPTER VII

PUPIL ACHIEVEMENT

The basic task of the public school is that of educating its pupils. Parents and critics alike continually emphasize that regardless of other concerns, it is the schools' business to teach the 3 R's. And for the most part, educators accept this underlying purpose. In this context, we posed the following question: "Did Abo's underground pupils achieve at a rate comparable to that found in other schools in Artesia?" We also raised a corollary question: "Did the Artesia pupils achieve at a rate that was comparable to pupils in schools other than in Artesia?" The last question was raised for two reasons. Legions of researchers have felt that the mere introduction of a research study tends to make everyone try just a little harder; this phenomenon is the well-known Hawthorne effect. Comparisons with schools far removed from the Abo Project might provide data upon this point. The second reason has been discussed earlier, but is worth mentioning again. If the Artesia school system tends to resemble other school systems in certain criticial (critical for learning) areas, then the findings from this study will gain in external validity. That is, our findings might apply to school systems other than Artesia.

Achievement was measured by administering the Stanford Achievement Tests four times: in the fall of 1962 and spring of 1963, and again in the fall of 1963 and the spring of 1964. Comparable data were obtained

from two school systems in Nevada. The Nevada data were one year behind those of the Artesia data, that is, these data (the Stanford Battery) relate to the school years of 1961-62 and 1962-63 (the Nevada data were gathered as part of an independent research project supported by the Faculty Research Committee of the University of New Mexico).

The analysis of gain scores poses certain problems (Harris, 1963). Crude gain, that is, the difference between fall and spring scores, has been severely criticized as an inadequate measure--inadequate because it fails to take into account either the pupil's ability or his level of initial knowledge. It has been frequently observed that bright pupils, or knowledgeable pupils, make higher gains than do their less able peers. Two acceptable approaches are analysis of covariance, or regression analysis. In both cases, one uses as the covariant either mental ability or initial knowledge, or both. A growing body of research has established that initial knowledge consistently correlates about 0.80 with repeated measurements (Bloom, 1963, pp. 385,6). Regression analysis was selected as the statistical tool, primarily because this technique permits one to include subclasses of various sizes. Consequently, we applied regression analysis to determine "Gain" scores for each class under consideration; pretest scores were correlated with post-test scores for each of 5 achievement test variables.

Simply stated, we computed for each teacher (or her class) a predicted spring score. This predicted spring score took into account the level at which the class started and the correlation between the fall and spring scores. We then compared the predicted spring score

with that which was actually obtained.

From this predicted score, we subtracted the actual spring score. Therefore, if a class achieved at a rate higher than predicted, a plus gain score resulted. And for those whose final scores were below the predicted values, negative gain scores resulted. Classes which achieved at or about the level predicted obtained zero, or near zero, gain scores. In this manner, gain scores were computed for each teacher, for each variable, for each of two years. The alchemy by which these scores were calculated is revealed in Appendix C. The consequences of these steps were simply these: teachers who started the fall with an above average class were expected to conclude the year at a correspondingly higher level; conversely, teachers whose pupils scored low in the fall were expected to achieve at a more modest rate.

The adjusted gain scores (predicted spring score subtracted from the actual spring score), hereafter referred to simply as gain scores, have several interesting properties. First, these gain scores tend to be independent of the pupils' fall scores (Bloom, 1964, p. 112). That is, the amount of learning that takes place is now a function of the teacher or the environment rather than a function of the pupil's ability. Consequently, analyses of gain scores should shed light upon the teacher's influence, or the environment's influence. Since it has been noted earlier that the various teachers under consideration were much more alike than they were different, it seemed reasonable to believe that environmental effects, if they existed, would have an

opportunity to appear.

Five subtests of the Stanford Achievement Battery were selected for intensive analysis. They were: Paragraph Meaning, Word Meaning, Spelling, Arithmetic Reasoning, and Arithmetic Computation. These 5 were chosen because all appear in the tests given to 4th, 5th, and 6th grade pupils, and these areas are recognized as being central to the school's curriculum.

The gain scores were calculated for each variable, for each teacher, for each of 2 years. The gain scores were averaged within each grade, for each school. This produced gain scores for each of the schools. The results are reported in Tables 18, 19, and 20. Table 18, "Adjusted Mean Gain by Year, School and Variable: Grade 4" shows how the six schools fared with their fourth grades.

The Gain Scores indicate the degree to which a teacher and her class reached the mean that was predicted for her. Plus scores show that the teacher's class achieved at a higher level than was predicted. Negative scores reveal classes that failed to reach the predicted level. An example may help to clarify matters. Suppose that Miss Johns' class starts the school year with a mean score of 4.10 in Paragraph Meaning, i.e., 4 year and one month. Her spring mean is 4.96. Her predicted spring score was 4.80. Therefore, her Gain Score is .16; that is, she gained .16 school years more than we had predicted. This is almost two months of gain. Tables 18, 19, 20, and 21 show the combined classes, rather than individual teachers.

Table 18

Adjusted Mean Gain by

Year, School and Variable: Grade 4

(Scores are in decimal fractions of a school year)

Variable	Year	Abo	Central	Hermosa	Yucca	Nev.I	Nev.II	F
Par.Meaning	1	.16	.08	-.40	-.52	.03	.30	1.03
	2	.01	-.08	-.09	-.10	.25	-.06	0.75
Word Meaning	1	.13	.18	.05	-.15	.06	-.12	2.13
	2	-.01	.04	.07	-.14	-.06	.19	0.51
Spelling	1	.49	.52	.48	.34	-.57	-.27	7.04*
	2	-.08	-.15	-.17	-.15	.02	.40	1.99
Arith.Reas.	1	.17	.04	.17	.22	-.07	-.08	0.38
	2	.20	-.10	-.08	.11	-.06	.05	1.22
Arith.Comp.	1.	.44	.08	.12	.48	-.10	-.33	2.71
	2	.11	-.23	.08	.06	-.18	.39	0.96

* F Ratio significant at 5% level.

Table 19

Adjusted Mean Gain by

Year, School and Variable: Grade 5

(Scores are in decimal fractions of a school year)

Variable	Year	Abo	Central	Hermosa	Yucca	Nev.I	Nev.II	F*
Par.Meaning	1	.00	-.14	.68	.15	-.25	.18	0.68
	2	.13	-.91	.25	.22	.35	-.35	2.32
Word Meaning	1	-.02	-.30	.32	-.02	-.04	.00	0.42
	2	-.02	-.50	.34	.04	.17	-.21	0.87
Spelling	1	.03	.08	.38	.36	-.19	-.14	0.91
	2	.09	-.66	.42	.20	.10	-.21	1.64
Arith.Reas.	1	-.02	-.62	.31	.10	.00	.06	0.56
	2	.06	-.42	.12	-.18	-.02	.31	0.78
Arith.Comp.	1	.11	-.22	.12	.16	-.14	.16	0.29
	2	-.16	-.41	-.20	-.23	.21	.41	1.76

*No significant difference in F Ratio

Table 20

Adjusted Mean Gain By

Year, School and Variable: Grade 6

(Scores are in decimal fractions of a school year)

Variable	Year	Abo	Central	Hermosa	Yucca	Nev.I	Nev.II	F
Par.Meaning	1	-.12	0.32	-.37	-.40	-.03	.81	1.66
	2	.40	.00	.18	-.48	.22	-.32	0.94
Word Meaning	1	-.20	-.10	-.08	-.16	-.05	.54	0.30
	2	.13	.04	.46	-.18	-.04	-.11	1.46
Spelling	1	-.13	.19	.28	.13	-.21	.11	1.10
	2	.24	-.36	.71	-.06	-.29	.06	4.83*
Arith.Reas.	1	-.11	-.43	.17	-.60	.15	.27	0.55
	2	.15	.23	-.02	-.04	-.14	.12	0.46
Arith.Comp.	1	.21	.04	.26	-.58	-.10	-.02	0.77
	2	-.12	-.48	-.14	-.46	.35	.24	2.14

*F Ratio significant at 5% level.

Table 18 shows, for example, that in Paragraph Meaning, the Abo classes during year 1 achieved at a level that was about 2 months more than the predicted value (.16 means, one and 6/10 months). In the same manner, we note that Central School pupils achieved at the level that was predicted; Hermosa pupils were 4 months below the predicted level; Yucca was 5 months below; Nevada I was at the predicted level, and Nevada II was 3 months in excess of our prediction. The F of 1.03 indicated that the differences in gains between the six schools lacked statistical significance. In other words, the variations noted could be attributed to chance, rather than to systematic variation between schools. The rest of the table should be read in the same way. The table shows that with one exception, the variations in gain scores for years 1 and 2 can be attributed to chance. The exception occurs in spelling during year 1; it appears that the Artesia schools exceed their predicted values, whilst the Nevada schools fall behind. It is interesting to note, however, that these differences faded away in year 2.

Tables 19 and 20, relating to grades 5 and 6 respectively, tell essentially the same story. The variations in gain scores between schools may be regarded as fluctuations due to chance. These analyses fail to suggest in any way that the Abo pupils encountered handicaps that were different from their peers in Artesia or Nevada. In other words, the data presented in Tables 18, 19, and 20 indicate that the Abo pupils achieved at rates that were comparable to their peers in other schools.

The information in Tables 18, 19, and 20 was further condensed

by adding the gain scores in each school for year 1, year 2, and for the combination of years 1 and 2. These sums were averaged to secure overall gain scores. The results of these analyses appear in Table 21, "Pooled Gain Scores by Schools, Grades and Years." The differences between schools were tested by the analysis of variance of unweighted group means (Lindquist, 1953). This summary table shows again that the overall gains obtained by the Abo pupils were comparable to those obtained by pupils in the other schools.

These data lead to the inescapable conclusion that during the two year period of time of the present study, the pupils attending the underground school-fallout shelter made the same degree of academic progress as pupils who attended conventional schools.

Table 21

Pooled Gain Scores by Schools, Grades and Years

(Scores are in decimal fractions of a school year)

Grade	Year	Abo	Central	Hermosa	Yucca	Nev.I	Nev.II	F
4	1	.28	.18	.08	.07	-.13	-.10	2.38
	2	.04	-.10	-.07	-.04	.00	.20	5.31*
Combined (1+2)		.16	.04	.01	.02	-.07	.05	1.00
5	1	.02	-.24	.36	.15	-.12	.05	5.33*
	2	.02	-.58	.19	.01	.12	.01	7.31*
Combined (1+2)		.02	-.41	.27	.08	.00	.03	8.90*
6	1	-.07	-.12	.05	-.32	-.05	.32	3.67
	2	.16	-.11	.24	-.24	.02	.00	2.23
Combined		.04	-.12	.14	-.28	-.02	.16	5.11

* F Ratio significant at 5% level.

CHAPTER VIII

PARENTAL REACTIONS

A telephone questionnaire was conducted with parents of children in four schools: Abo, Central, Hermosa and Yucca. As explained in another part of this study, Abo is the underground, windowless school in Artesia, New Mexico, Yucca is an above-ground, windowless school in Artesia, and Central and Hermosa are conventional schools in Artesia. There were a total of 89 parents contacted. These parents represented a stratified random sample of parents of grades 1, 4, and 6 as discussed in Chapter III, "Procedures."

The questions are listed below, together with accompanying tabulations of responses and some cursory discussion of the significance of the results.

Question 3 asked, "Do you think it was a good idea to build the Abo school?"

Group Response *	Abo	Central	Hermosa	Yucca
Yes	24	22	17	16
No	0	1	5	3

* It must be kept in mind that these figures represent groups of parents whose children attended the designated school.

As can be seen in the table, the Abo parents were unanimous in their response in favor of Abo. The other three groups had a few No responses, however, the majorities were in favor of Abo.

Question 4: "Do you think present schools should be equipped,

if possible, to serve as shelters in case of an attack?"

Group Response	Abo	Central	Hermosa	Yucca
Yes	18	23	14	15
No	2	0	7	4

The majority in all four groups responded "Yes." It is interesting to note that the Central school parents were unanimously in favor of equipping the schools to serve as shelters.

Question 5: "Do you think future school buildings in Artesia should be of some school-shelter type?"

Group Response	Abo	Central	Hermosa	Yucca
All	8	4	5	2
Portion	7	17	8	17
None	1	2	6	0

The responses were in three areas: all school space, a portion of every building, no shelter space. From the table, we notice that 68 of the parents were in favor of all or some portion of the building being of shelter-type. Only 9 parents wanted no shelter-type schools.

Question 6: "If such construction costs additional money (over what a regular school should cost), who should pay this additional cost? The local district? The state? The Federal Government?"

Group Response	Abo	Central	Hermosa	Yucca
Local	14	9	6	8
State	13	10	8	8
Federal	7	14	14	9

(Note: Some parents responded to more than one category)

The largest number of Abo parents were in favor of local support, second was state and last was federal support. In the other three groups, the pattern was reversed, with 37 of the total 86 responses favoring federal finance. It should be noted here, that some parents in all four groups responded to two and three sources of financial responsibility, indicating that they consider that the cost should be absorbed by two or three of the levels of support. This accounts for the total of 120 responses from 89 parents.

Question 7: "If you could choose any school in Artesia, which one would you choose for your child to attend?"

School Preferred	School that Parents' Children attend			
	Abo	Central	Hermosa	Yucca
Abo	22	11	5	6
Hermosa	0	0	15	1
Central	0	10	0	0
Yucca	0	0	1	10

The table discloses how many Abo parents preferred Abo school; how many Abo parents preferred Hermosa; how many Hermosa parents preferred Central, etc. As the table indicates, each group tended to favor the school its children were attending. All Abo parents wanted their children to attend Abo, whereas 5 Hermosa parents preferred Abo and 1 preferred Yucca. 11 Central and 6 Yucca parents preferred Abo.

In summary, it can be seen that the Artesia parents reached in this survey held positive attitudes toward the school-fallout shelter concept.

CHAPTER IX

SUMMARY AND CONCLUSIONS

This study was an investigation into the effects of an elementary school-fallout shelter upon the educational climate within that school. The Abo School in Artesia, New Mexico, when it opened in the fall of 1962, was the first of its kind. Critics and professional educators alike raised serious questions on the possible ill effects that such a structure might have upon its occupants. Attention was focused upon a variety of areas: costs, teacher variables, pupil variables, achievement, and parental reactions.

Costs of construction were about 21% higher for the Abo fallout shelter than for a conventional structure. The higher cost included all special features of a fallout shelter, including items such as storage space, air filters, steel doors, and mechanical equipment. Costs for electricity were about the same in Abo as for a windowless school; both were higher than for conventional schools. The costs of heating and cooling were considerably less for the Abo school. The costs for custodial services in the Abo School were somewhat lower than for other schools in Artesia.

Several teacher variables were examined: attitudes, personnel characteristics (age, experience, etc.), anxiety, and personality. Our analyses showed that the Abo teachers were like the other teachers in Artesia. Further, we found that the Artesia teachers in general were very much like their peers in two school systems in Nevada.

The study of pupil variables included anxiety and attendance. No evidence was found to indicate that the Abo pupils were more anxious

(in test anxiety or in general anxiety) than pupils attending conventional or windowless schools in Artesia. The attendance rate of the Abo pupils did not differ significantly from the rates found in other Artesia schools.

The Abo pupils achieved (as measured by the Stanford Achievement Tests) at about the same rate as other pupils in Artesia, and in two Nevada school systems.

In sum, we found no evidence that would raise questions about the feasibility of combining a fallout shelter with the educational function. Our data consistently showed that the Abo pupils did as well, if not better, than their peers attending more conventional schools. It may be argued that two years is too short a span for such a study, that a longer period would be required to fully explore the long term effects of this structure upon its pupils. This may be true. We can only note that the evidence at hand suggests that an elementary school-fallout shelter produced no measurable ill effects during the two years of our investigation.

At several places in the report, attention was called to the similarities between the Artesia staff and pupils and the staffs and pupils of two Nevada school systems. It seems that since these three school systems were more alike than different (in teacher personality as measured by the Edwards Personal Preference Schedule, and in levels of academic achievement) that a further conclusion is justified, which is namely this: underground schools in other sections of the Nation

are likely to have effects upon their pupils comparable to those found in Abo. And in Abo, we found no negative influences which could be in any way attributed to the fact that Abo was a fallout shelter.

Communities who consider the construction of a facility such as the Abo School should base their decisions on factors other than the possible ill effects the structure might have upon its children. Dig and explore and prod and pry as we did, we could find no evidence of ill effects upon pupils, teachers, or parents.

CHAPTER X

RECOMMENDATIONS FOR FURTHER STUDY

The Abo Project examined a number of variables relevant to the pupils and their environment for learning. To say that the work is completed would be indeed rash. The present work should be viewed as one of ordering the domain, perhaps, or one of clarifying certain of the variables. Much remains to be done.

The entire question of the effects of school environment upon health needs to be explored. Do children with certain alergic reactions respond more favorably to the filtered air of the Abo environment? Does continued exposure to artificial lighting deleteriously affect vision?

We observed the pupils and their teachers for only a brief span of time. What happens to pupil anxiety over a longer period? What of pupils who have attended conventional elementary schools who are then assigned to an underground junior high school, as will be the case this fall (1964)? Does anxiety increase? Decrease? And of the pupils in the elementary schools; what happens to their levels of anxiety over longer periods of time?

What effects does the school structure have upon teacher behavior? Do teachers come to act and behave differently when assigned to a school-fallout shelter? And if they do, what does this mean for the pupils?

The question of school maintenance costs must be studied over a period of time, say 5 to 10 years. Can one expect to recover the initial higher capital outlays for underground structures in decreased

maintenance costs? Studies should be planned, and planned soon to answer these and related questions.

In sum, it can be seen that many questions remain unanswered. It can also be seen that the Artesia school environment provides a unique environment; unique in that structural aspects of the school environment become independent variables. Researchers should seize this opportunity and exploit it fully to the end that basic problems in our profession be resolved.

APPENDIX A

Analysis of Variance for Table 8

	Source	df	sum of squares	mean square	F
Holemon Scales					
Attitude toward parents	schools	3	14.71	4.90	0.32
	within	63	968.04	15.36	
	total	66	982.75		
Attitude toward teaching career	schools	3	16.82	5.61	0.49
	within	63	721.60	11.45	
	total	66	738.42		
Attitude toward administration and regulations	schools	3	22.54	7.51	0.64
	within	63	738.66	11.72	
	total	66	761.20		
Moeller, "Sense of Power"					
	schools	3	24.16	8.05	0.74
	within	61	666.82	10.93	
	total	64	690.98		

APPENDIX B

Analyses of Variance for Table 11

Edwards Personal Preference Schedule Variable

	Source	dr	sum of squares	mean square	F
Achievement	schools	2	58.72	29.36	1.62
	within	45	813.26	18.07	
	total	47	871.98		
Deference	schools	2	13.39	6.70	0.7
	within	45	422.59	9.39	
	total	47	435.98		
Orderliness	school	2	18.09	9.04	0.3
	within	45	1295.16	28.78	
	total	47	1313.25		
Exhibitionism	schools	2	124.35	62.17	3.70
	within	45	756.32	16.81	
	total	47	880.67		
Autonomy	schools	2	5.75	2.87	0.18
	within	45	709.92	15.78	
	total	47	715.67		

(Appendix B continued)

APPENDIX B (Continued)

	Source	df	sum of squares	mean square	F
Affiliation	schools	2	45.52	22.76	1.36
	within	45	754.96	16.78	
	total	47	800.48		
Intraception	schools	2	20.72	10.36	0.72
	within	45	642.28	14.27	
	total	47	663.00		
Succorance	schools	2	57.13	28.56	1.76
	within	45	731.54	16.25	
	total	47	788.67		
Dominance	schools	2	279.99	139.99	4.64
	within	45	1357.68	30.17	
	total	47	1637.67		
Abasement	schools	2	123.58	61.79	2.92
	within	45	952.34	21.16	
	total	47	1075.92		
Nurturance	schools	2	0.03	0.02	less than .1
	within	45	1013.29	22.51	
	total	47	1013.32		

(Appendix B continued)

APPENDIX B (Continued)

	Source	df	sum of squares	mean square	F
Change	schools	2	122.55	61.26	1.99
	within	45	1384.70	30.77	
	total	47	1507.25		
Endurance	schools	2	54.97	27.48	1.71
	within	45	724.28	16.10	
	total	47	779.25		
Heterosexuality	schools	2	209.40	104.70	1.23
	within	45	3821.27	84.90	
	total	47	4030.67		
Aggression	schools	2	69.76	34.88	1.59
	within	45	984.22	21.87	
	total	47	1053.98		

APPENDIX C

Regression Analysis for Determining Adjusted Gain Scores for Teachers, Classes and Schools

---

Predicted Post-Test (Spring) Mean

$$\bar{Y}'_a = \bar{Y} + r \frac{SD_y}{SD_x} (\bar{X}_a - \bar{X})$$

$\bar{Y}'_a$ = Any teacher's predicted post test mean, for any variable.

$\bar{Y}$ = Mean spring score for all pupils at a given grade level for any variable.

r = Correlation coefficient between fall and spring tests, for all pupils, within a given grade level, for any one variable.

SD_y = Standard deviation for spring scores, for all pupils at a given grade level, for a given variable.

SD_x = Standard deviation for fall scores, as above.

$\bar{X}_a$ = Mean fall score for a given class, for a given variable.

$\bar{X}$ = Mean fall score for all pupils in a given grade level, for a given variable.

Adjusted gain Scores

$$G_a = \bar{Y}_a - \bar{Y}$$

G_a - Adjusted gain score for any class, for any variable.

(These procedures are based upon Guilford, 1956, pp. 265-75)

LIST OF REFERENCES

Bloom, B.S., Stability and change in human characteristics, N.Y.: Wiley, 1964.

Bloom, B.S., "Testing cognitive ability and achievement," in Gage, N.L. (ed.) Handbook of Research on Teaching, Chicago; Rand McNally, 1963.

Davidson, K.S., "Interviews of parents of high anxious and low anxious children," Child Development, 1959, #30, pp.341,351.

Dunn, J.A., Paper presented to the Michigan Academy of Science, Kalamazoo, Michigan, March 23, 1963.

Edwards, A.L., Manual for the Edwards Personal Preference Schedule, rev. N.Y. Psychological Corporation, 1959.

Feldhusen, J.F., and Thurston, J.R., "Personality and adjustment of high and low anxious children," J. Educ. Res., 1964, #57, pp.265,267.

Farnsworth, P.R., and McNemar, Q., (eds.), Annual review of psychology, Palo Alto, Calif.: Annual Reviews: 1960.

Fiske, D.W., "Review of the Edwards Personal Preference Schedule," in Buros, O.K. (ed.) Fifth mental measurements yearbook, Highland Park, N.J.: Gryphone, 1959.

Getzels, J.W., and Jackson, P.W., "The teacher's personality and characteristics," in Gage, N.L. (ed.) Handbook of Research on Teaching, Chicago: Rand McNally, 1963.

Guilford, J.P., Fundamental statistics in psychology and education, 3rd ed., N.Y.: McGraw-Hill, 1956.

Hammes, J.A., "Manifest anxiety and perception of environmental threat," J.Clin. Psych., 1959, #15, pp. 298-300.

Harris, C.W. (ed), Problems in measuring change, Madison: University of Wisconsin, 1963.

Hearings Before Committee on armed services, H.R., 88th Congress, No. 20, Part II, Vol. I, pp.3607,3693,4288,4471; No. 22, Part III, pp.5620,5671, 1963.

Hearings before Subcommittee No. 3, Committee on armed services, H.R., 88th Congress, No. 11, Part I, p.3116, 1963.

LIST OF REFERENCES (Continued)

Holemon, R.L., Attitude change of the student teacher: a test of the ABX Model, Ed. D. Dissertation, St. Louis: Washington, University, 1963.

Lindquist, E.F., Design and analysis of experiments in psychology and education, Boston: Houghton Mifflin, 1963.

Lutz, F.W., and Lutz, S.B., Interim report of the Abo Project, Santa Fe, New Mex., Dept. of Education, 1964.

Moeller, G.H., The relationship between bureaucracy and school system organization and the teacher's sense of power, Ed.D. Dissertation, St. Louis: Washington University, 1962.

Morse, W.C., et al., "A study of school classroom behavior from diverse evaluative frameworks: developmental, mental health, substantive learning, group process," HEW, OE Contract #8414, 1961.

Murray, H.A. et al., Explorations in personality, N.Y.: Oxford Univ. Press, 1938.

Redl, F., and Wattenberg, W.W., Mental hygiene in teaching, 2nd ed., N.Y.: Harcourt, Brace, 1959.

Sarason, I.G., "Test anxiety and intellectual performance," J. Abnormal Psychology, 1963, #66, pp.73-75.

Sarason, S.B., et al., Anxiety in elementary school children, N.Y.: Wiley, 1960.

Taylor, J.A., "A personality scale of manifest anxiety," The Journal of Abnormal and Social Psychology, Vol. 48, No. 2, 1953, pp.285-290.